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WEBB'S AIR-PUMP.

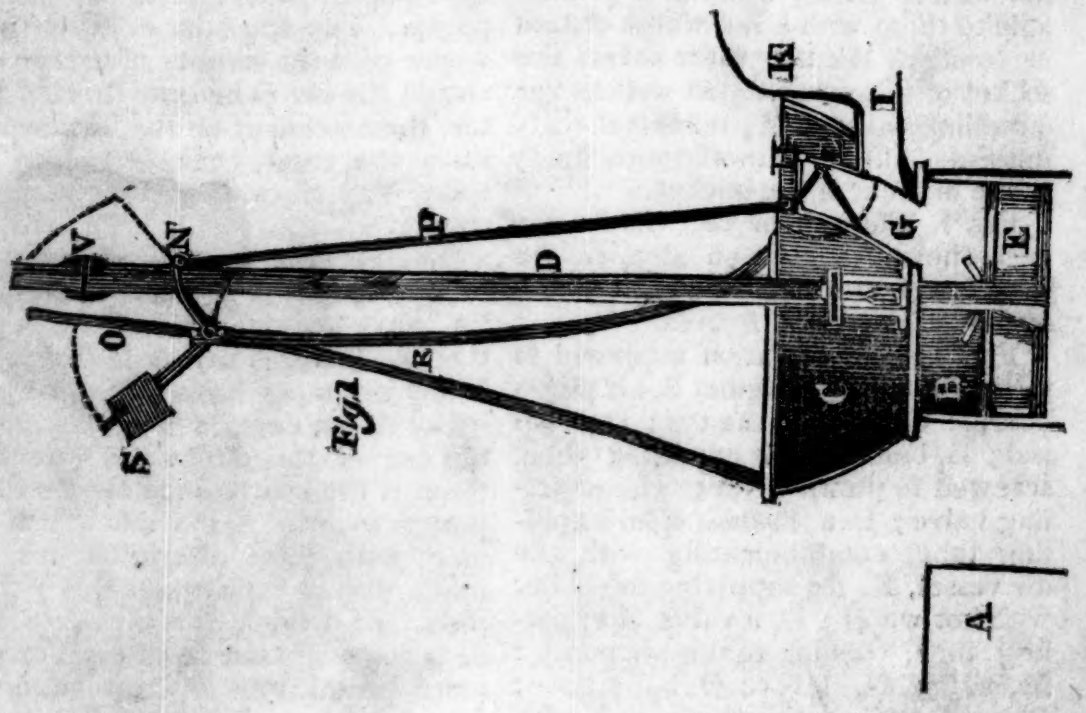


Fig. 1

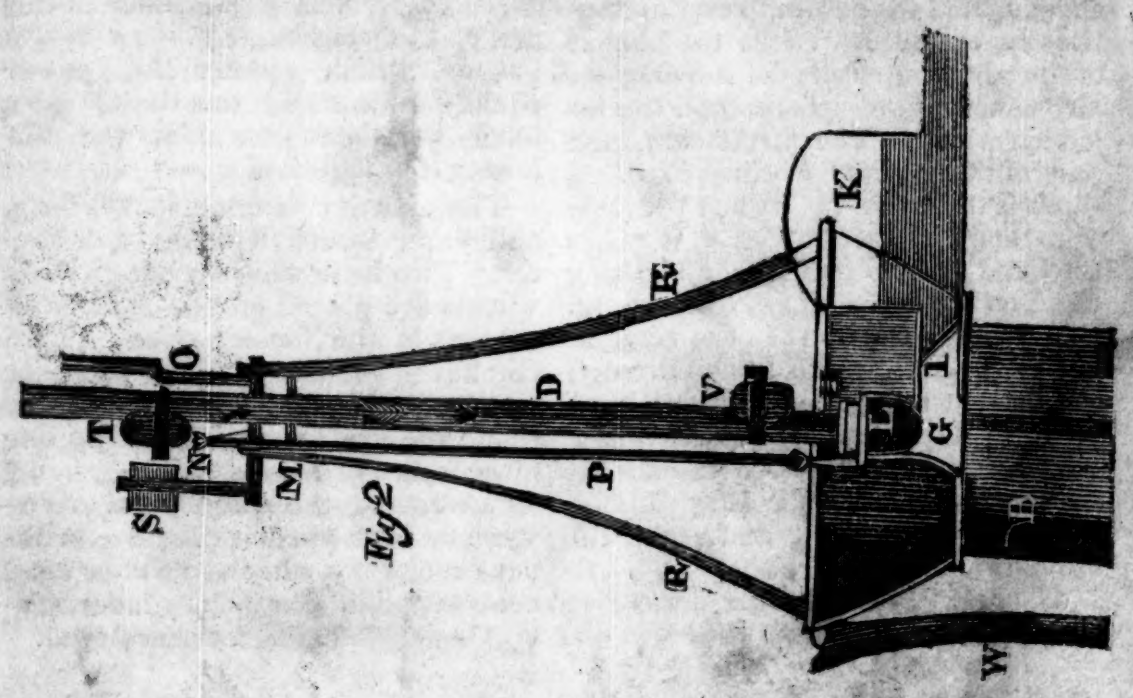


Fig. 2

AIR PUMP, WITH A HOT WATER FEEDING BRANCH.

SIR,—This is a contrivance for making the air pump of a steam engine perform the office of the hot water pump, in addition to its other designed uses.

The air pump I have copied from an engine designed by Mr. Murray of Leeds, which had a basin, hot well, or cistern on the top for containing the hot water, which, I think, is preferable to those with a hot water cistern in front, as the hot water covers the socket of the pump top as well as the expelling valve, and prevents the admission of the air (a more subtle fluid) in the descent of the bucket.

Fig. 1. The top of the condenser, A, is shown, to give an idea of the situation of the air pump. The same letters refer to both figures.

Fig. 2, is an elevation supposed to face centre of the engine: B, air pump barrel; C, basin on the top; D pump rod; E, bucket; G, expelling tube, screwed to pump cover; H, expelling valve; I, a branch from expelling tube, communicating with the air vessel, K, for supplying the boiler with hot water; L, a valve in expelling tube, opening to the air pump; M, axle; N, lever; O, hand gear; P, rod for connecting the lever N with the lever attached to the valve L; RR, iron frame fixed to basin for supporting the valve M, &c.; S, a tumbling counter weight to rod P; T V, slides bolted to the pump rod diametrically opposite. When the bucket of the air pump ascends, it brings up air, uncondensed steam, and the injection water. The air, steam, and part of the injection water is expelled through the valve H. When the slide V ascends, as seen in Fig. 1, it raises the hand gear O; the lever N, being fixed on the same valve, lifts the rod P, and shuts the valveL, the remainder of the hot water is forced through the branch I into the air vessel K; a valve in the branch I, prevents the water returning. When the bucket descends, the slide T (Fig. 2) depresses the lever N, and opens the valve L again.

W (Fig. 2) is a pipe for conveying the surplus water from the basin C.

The dotted lines in Fig. 1, show where the hand gear, &c. was previous to its being moved by the slide V.

The slide V can be so adjusted on the rod that the supply of water to the boiler can be regulated to any quantity, which is not the case with hot water pumps, which are made of a larger bore than wanted, that the boiler may not be short of water, from any imperfections or wear in the pump. The quantity of water used varies with the density of the steam; should the boiler become short of water, the attendant on the engine can raise the hand gear O before the slide V strikes it, and increase the supply.

The beam in the steam engine is said to rob it of part of its power, being "a heavy body alternately set in motion and brought to a state of rest."—Many attempts have been made to make steam engines without beams: but one of the difficulties attending them is the contrivance for the three pumps to act. A marine steam engine, with some alteration, may be made with one pump on this principle; and I think this invention may be of some assistance in perfecting a more practicable rotatory motioned steam engine. J. WEBB, Engraver.

NEW STEAM ENGINE.

From the Rahway Advocate.

Mr. R. Dennis, a mechanic of this place, has constructed a new Steam Engine, which applies the power equally quite round the shaft. We have obtained from him the following description of it:—

The cylinder is nine inches long, and water wheel 18 inches in diameter. Two loose wheels and two fixed wheels are placed on the shaft with catches in the former operating on notches on the latter. The sliding or loose wheels are moved half way round the shaft and back, in opposite directions, by means of a sliding frame rolling the water wheels forward or backward at pleasure, without cranks, fly-wheels, level or dead centres. The common cylinder, piston, boiler and condenser are used.

WARPING VESSELS UP RAPIDS.

SIR,—I observe, in a Number of the Mechanics' Magazine, for January, a Plan for Warping Vessels up Rapids, and now in operation on the Delaware. The principle is precisely that which occurred to me five years ago, when in Canada, and which, by the united action of machinery and the current, I wished to apply to steam vessels navigating the St. Lawrence. I accordingly inserted an advertisement in the "Canadian Courant," published in Montreal, addressed to the proprietors of those vessels.

Allow me, Sir, to present you with the following detail, under the expectation that you will insert it, and, by placing it on record, do me that justice which I consider is due to me:—

"*To the Proprietors of Steam Boats navigating the St. Lawrence.*

"The proprietors of Steam Boats navigating this river, are respectfully informed that the subscriber is possessed of a plan by which the ascent of those vessels up the rapid below this city, may be greatly expedited. The principle is such, that its extension may greatly improve the mechanical navigation of the rivers of America, open new routes for its application, and by giving it action where it has heretofore been dependent on the operation of towing, render it superior to natural impediments.

"T. H. BELL.

"Montreal, June 20, 1820."

I explained the plan to the Editor of the "Canadian Courant," Mr. Driscol, and the following are his remarks, which appeared in the same paper:—

"INVENTION.—An ingenious person in this city has lately favoured us with a description of an addition to the present machinery of a steam boat, by which those vessels may be made to stem currents hitherto impassable. It is well known that in currents of a certain rapidity, the mechanical power becomes totally ineffective, the descent of the water being quicker than the revolution of the paddles. In order to ascend, recourse must, therefore, be had to cattle or manual labour. To obviate this inconvenience is the intention of the present improvement, it being calculated to propel a steam vessel *twenty-five yards per minute*,* in any current, the mechanical power increasing as the velocity of the water increases. Though not deeply versed in mechanics, so simple is the principle, we venture to predict that it will be found to answer all that is above attributed to it; an ingenious mechanic, not the inventor, being confidently of the same opinion."

The above advertisement appeared for some weeks, but was unnoticed by those to whom it was addressed, and I never again agitated it until my return to England, when, still considering it to be the greatest improvement that could be made in the mechanical navigation of American rivers, and highly desirable on the St. Lawrence, I sent a drawing and description to the Society of Arts, but without any view to a reward; for, to be able to add a single fact to science, is, I consider, a sufficient remuneration for the trouble of its discovery.

The following is a copy of my letter which accompanied the drawing, and the Secretary's reply:—

"Alnwick, June 8, 1822.

"SIR,—I beg leave, through you, to submit the enclosed drawing of an improvement in mechanical navigation, to the inspection of the Society for the Encouragement of Arts, &c.

"In my passage from Quebec to Montreal, in November, 1819, I observed that the power of the engine became totally ineffective in a current called *Sante Marie*, a little below the city of Montreal. In consequence, recourse was had to cattle and manual labour to tow the vessel against the stream. It occurred to me, at the instant, that the power of the engine might be applied to wind the vessel up, or to render her automatic in any current, by a very simple arrangement of machinery, and an arm, as it were, be added to mechanical navigation. To effect this, I would fix the cog-wheel, A, on the axle of the water wheels, which would drive the wheel, B, and its concentric stream, or drum, C. At the head of the current, or a little above where the engine would be sufficient to impel the vessel, I would sink a kedge, with a buoyant hawser attached, to remain floating in the stream. This

* This remark supposes the paddle-wheels to perform 25 revolutions per minute, and the diameter of the drum to be only one foot.

hawser being grappled on board, and applied to the drum, C, one man or more taking it off, the vessel would herself ascend the current with a velocity proportioned to the diameter of the drum. I may observe, that the current itself would assist the engine, and thus the *very impediment of navigation be made one of the means of overcoming it.*

"T. H. BELL.

"P. S. In situations such as the current Sante Marie, a kedge would be unnecessary, for the hawser could be fastened on shore, and two, applied alternately, would haul up the vessel. This principle of motion might be otherwise usefully extended. One application, perhaps of some magnitude, would be its adoption on canals, where the action of water-wheels is injurious to the banks. Boats, in canals, which at present are dragged by horses, might be towed, several together by a single coiling boat, driven by steam or horse-power. Hawsers might be made of any length and, where the canal was winding, be retained in their proper position by rollers placed along the banks.

"Arthur Aikin, Esq."

"Society of Arts, &c.

"Adelphi, London, Dec. 3, 1822.

"SIR,—I am directed to inform you, that your Plan for Warping Steam Boats up Rapids, has been considered by a Committee appointed for the purpose, and their opinion confirmed by the Society; the result of which is, that your endeavours, in this instance, are not entitled to their reward, but that they consider themselves obliged to you for your good intention and exertions.

"ARTHUR AIKIN, *Sec.*

"Mr. T. H. Bell."

With these remarks, I remain your most obedient servant,

T. H. BELL.

Alnwick, March 4, 1825.

The principle of Mr. Bell's plan is evidently the very same as that of Col. Clark, whose success, in reducing it to practice, furnishes the best commentary that can be offered on the soundness of the judgment passed upon it by the Society of Arts.—ED. LOND. MEC. MAG.

SIR,—By the foregoing extract, which appeared in the 85th Number of the "London Mechanics' Magazine, it appears that Mr. Thomas H Bell, of Alnwick, (Eng.) thinks that injustice has been done him, in respect to priority of discovery of a "Plan of Warping Vessels up Rapids;" but in this he labours under a mistake, as will appear by a comparison of dates from which we severally claim. This publication is dated "March 4, 1825;" and Mr. Bell remarks, that "*The principle*," refering to the plan of navigation which I carried into effect on the Delaware, "*is precisely that which occurred to me five years ago, when in Canada.*" Now this would only extend his right to the discovery back to 1820; while I actually made successful experiments on the principle as early as the summer of 1813, as will appear by a pamphlet I published in 1823, and as can be proved by respectable witnesses.

Yours, very respectfully,

E. CLARK.

New-York, Aug. 1825.

MANUFACTURE OF INDIGO.

The plant from whence indigo is drawn grows in several parts of the East Indies. It somewhat resembles rosemary, and rises to the height of from 3 to 4 feet, bearing a flower like that of a thistle, and having a seed like fenegreek. When the plant is arrived at a certain height, and the leaves are in good condition, they are stripped from the stalks, and thrown into large pits half filled with water. Here they are bruised and stirred about till the water appears very thick and muddy, and after a few days settling, the water is drawn off, and the slimy sediment taken up in baskets, which are made into flat cakes, and afterwards dried in the sun. The people employed to sift the indigo, stop their nostrils, keep a cloth before their faces, with little holes for their eyes, and drink milk every half hour, to preserve them from the penetrating qualities of the dust, which, notwithstanding all their precaution, makes them spit blue for some time after. My informant tells me he placed an egg one morning near the sifters of indigo, and found

the contents of it quite blue when he broke it in the evening.

This is the method of making indigo at Serquech, a large town near Amadabat, which is reckoned as good as any in the world: there is another method they have of making indigo, which I think is far preferable to the other. The leaves of this plant are thrown into a kind of vat, and covered with water, in which they are boiled for four-and-twenty hours, and a scum swims on the top, with all the different colours of the rainbow. The water is then drained off into another vessel, where it is briskly stirred about till it becomes of a deep green, and till the grain (as they call it) forms itself. This they discover by taking a little of it out, and spitting in it, for if that occasions a bluish matter to subside, they leave off stirring the liquor; the matter then precipitates itself to the bottom of the vessel, and when it is well settled, they pour off the water. After this they take out the indigo and put it into linen bags to drain; which done, they put it into shallow wooden boxes; and when it begins to dry they cut it into slices, and let them harden in the sun.

I remain yours sincerely,

JOHN. H. BARRETT.

Lond. Mec. Reg.

ROBERTS'S HOOD AND MOUTH-PIECE.

SIR,—As the agent of Mr. J. ROBERTS, for the sale of his HOOD AND MOUTH-PIECE, I shall feel much obliged by your inserting in your excellent Register the following reply to the well meant suggestions of your correspondent, J. S.

In the first place, sir, the use of valves did not escape the attention of either Mr. Roberts or some of his scientific friends who admired his ingenuity; but on consideration, it was determined that they would be not only useless, but injurious; as the manner in which the impure air is neutralized at the bottom of the funnel has all that effect, and two valves, as recommended by J. S. would be dangerous, for if by accident either valve was fixed, suffocation must ensue to the wearer; and so far from the respiration being at all laborious, as described, the alternate action of inspiration and expiration in the tube is regular, pleasant, and easy, and the great acceleration of the pulse and *apparent* fatigue and lassitude at the two experiments arose from the heat only, which varied from 90 to upwards of 100 degrees, Fahrenheit, and it was so decided by the medical gentlemen who were present, as not the smallest extraordinary excitement had taken place in the lungs.

With respect to the shape of the tube, it is clear that your correspondent must be ignorant of the action of the apparatus, or he would be convinced that the funnel-shaped enlargement is absolutely necessary to its performance, as by that funnel the whole of the neutralization of the acids and impure air is carried on. I will not trespass farther in reply, but merely to observe that considerable improvements have been already made in its manufacture, particularly as to its lightness, especially for the purposes of workmen in a dangerous atmosphere, the whole of which I should be very happy to show your correspondent, and explain the action of the apparatus, if he will favour me with a call. W. JONES.

8 Tysoe-street, Clerkenwell. *ib.*

EXTRACT FROM MR. OGG'S LECTURE BEFORE THE MECHANICS' INSTITUTE, LONDON.

Previous to an illustration of the effects of steam as applied to machinery, Mr. Ogg exhibited to the audience a rugged piece of iron, which had nothing remarkable in its appearance, but might appear interesting from the circumstances connected with it.—Some time ago a tremendous explosion took place in a manufactory of glue at Camberwell, where the principle of a *digester*, similar to Papin's was applied to the extraction of glue from *bones*. For this purpose, high-pressure steam was thrown into a strong vessel, that the intense heat of the steam might dissolve the particles in the bones required for the production of glue. It was necessary to

construct a larger boiler, capable of supporting a higher degree of pressure; and when this boiler was fixed, the proprietor of the manufactory and the engineer were present to see it heated for the first time, and witness its effect. According to the account given to Mr. Ogg, the pressure applied to the boiler was not nearly equal to what it was supposed capable of supporting, but when the assistant was desired to turn a stop-cock, he found himself unable to effect it, and that moment an awful explosion took place. The effect was terrific, and the resistance overcome was immense. The piece of tough wrought iron exhibited by the lecturer, was part of the boiler, which, from its magnitude, must have weighed several tons; yet the sides were torn away from the bottom as completely as if it had been made of wood and separated by a saw. It carried away the floor, and the roof above it, and after reaching half as high again as the lofty chimney of the steam engine, it fell upon another building, which it crushed and destroyed in its descent, and came like a mighty ruin to the ground. *ib.*

LETTER FROM CAPT. J. DAVISON TO THE RIGHT HONOURABLE HUDSON'S BAY COMPANY.

HONOURABLE SIRS,—

I beg to lay before you the result of the experiment and observations on Pope's Patent Dipping Needle Compass, which your Honours were pleased to send for a trial on board your ship, 'The Prince of Wales,' under my command, on our voyage the last season.

It affords me pleasure to state, that I found the compass in question very superior to the common one, from its unusual steadiness in rough weather. It is hardly necessary for me to say, that with the motion of the vessel all compasses become more or less agitated, and a difficulty arises to the mariner to keep the course. Pope's Compass keeps its points with greater accuracy than the common compass. More improvements are produced, in my opinion, from Pope's Needle being allowed to dip instead of being fixed horizontally; and also from the circumstance of his card being perforated to admit a free passage of air underneath.

Another point of some importance I think it right to mention, which is, that the dip was increased in a higher latitude North.

On the whole, I have no hesitation in saying, that his invention possesses considerable advantages, and will no doubt come to a general use. I would wish to add, that it would be desirable that two flys should be sent with every Compass; a heavy one for stormy weather, and a light one for fine.

Your Honours' obedient servant,

JOHN DAVISON.

January 12th, 1825. *ib.*

FIRE-PROOF AND PLANK FLOORS.

SIR,—The imperfection of the old construction of floors for the purposes of machinery, has induced some people in this neighbourhood to alter the flooring system altogether; and instead of joists, flooring-boards, tiering underneath, &c. (of which they formerly consisted) two planks, of quite a different nature, have been adopted, viz fire-proof and plank floors.

For the fire-proof floors, the columns and beams are made of cast iron, and are secured in their places with wrought iron bars, that traverse from beam to beam; upon a margin underside the beams spring the arches of brick-work; these are filled to a level on their upper side with rubbish, and are covered with flags or tiles.

For plank floors, iron columns and beams are used; but the beams are flat on their upper side for the planks to lay upon; three-inch planks are then jointed and ploughed on the edges, for the purpose of admitting slips of sheet iron (called tongues) to enter half way into each plank, so that no dust may get through from the upper side.

These are certainly improvements on the old plan, as they possess the advantages of stability, and deprive vermin of their harbours. The ad-

vantage of fire-proof floors are steadiness, durability, and saving the insurance: but then the first expense is great; they take up more head-room, and the tiles or flags with which they are covered are unhealthful to the operatives, on account of their coldness. The plank floors, though they are both cheaper and firmer than those on the old plan, have nevertheless their disadvantages; for though the floor may be made, yet let the timber be ever so well seasoned, when the rooms are ready for use, and must be kept up to the required temperature, the joists will open, and the floor becomes pervious to both dust and water, which, with the tremor produced by the machinery at work, creeps round the dowel or tongue, and the consequences are serious to the machinery underneath. Besides, when the floor has become so deteriorated as to require repairing in the passages, the whole length of the planks must be taken up, from beam to beam, which will be attended with bad consequences to any machinery that may stand upon them, or to any fixtures underneath.

These considerations have induced me to turn my attention to this subject. I propose that instead of three-inch planks, one and a half shall be used, laid upon iron beams, in two courses, one upon another: they shall both stretch the same way, and the upper boards shall break the joints of the lower; underneath the upper, and above the lower joints, slips of sheet iron, about three inches broad, must be laid, and kept in their places with a few nails; it will be necessary to screw the boards together in several places, to give them firmness. When this floor is finished, the joints will be good, and remain so, whatever temperature they may be exposed to. They will have another advantage over the present plank floors; when the upper course is done, they may be renovated without breaking through the floors.

Another improvement may easily be made in the iron columns. Let their diameter be as great as convenient, for the purpose of enlarging their internal capacity, and let each column in every room have a cock, or any other application, for the purpose of emission: there must be a cistern on the top of the building (in case of accidents by fire, or for any convenient purposes where water may be wanted) and this cistern must be attached to the lifting-pump of the steam engine. It will be necessary that each column be connected either at top or bottom, so that the water may flow through the whole, and they must likewise have air-pipes attached to them. Now, suppose the columns to be five inches bore (which is common) and the building six stories high, the average height of the stories nine feet six inches, length ninety feet by forty-eight feet, it will then contain eighteen columns fifty-seven feet long each, making in the whole a column of water one thousand and twenty-six feet long, and five inches diameter. Now $5\times5\times,7854=19,635$, area of bore; $19,635\times57$, length of column, $=13430,34$, contents of one column; and $13430,34\times18,=872$, imperial gallon. Here, then, is a capillary supply of water in every part of the building, which may be constantly maintained by feeding the cistern above from the engine. The importance of an immediate and convenient supply of water in every part, and in such extremities, needs no comment.

But they may be made useful in another way, viz. as ventillators. Let there be openings in each column, near the ceiling in every room, and let the whole of the columns connect with a horizontal pipe in the roof, (made of sheet iron,) and of sufficient capacity to give them draft. This pipe may be inserted in the chimney, provided it is made to dip a little before it enters, to prevent sparks or soot descending into the rooms; by this means the rooms may be ventilated from a great portion of dust, impure air, and superfluous heat, without opening the windows. Should this be doubted, let it be remembered that the sum of the orifices of the vertical pipes amounts to no less than 353,43 square inches.

Your obedient servant, R.

Manchester, Feb. 13, 1825.

Lond. Mec. Mag.

RECEIPTS FOR LACQUER.

Pale Tin Plate Lacquer.

Strongest alcohol	4 oz.
Powdered turmeric	2 drachms
Hay saffron	1 scruple
Dragon's blood, in powder	2 scruples.
Red Saunders	½ scruple

Infuse this mixture in the cold for 48 hours, pour off the clear, and strain the rest, then add

Powdered shellac	½ oz.
Sandrach	1 drachm
Mastic	1 drachm
Canada balsam	1 drachm

Dissolve this in the cold by frequent agitation, laying the bottle on its side, to present a greater surface to the alcohol; when dissolved, add 40 drops of spirits of turpentine.

Deep Gold Lacquer.

Strongest alcohol	4 oz.
Spanish annotto	8 grains
Powdered turmeric	2 drachms
Red Saunders	12 grains

Infuse and add shellac, &c. as to the pale tin lacquer, and, when dissolved, add 30 drops of spirits of turpentine.

N. B.—Lacquer should always stand till it is quite fine before it is used.

Lond. Mec. Mag.

ON CENTRIFUGAL FORCES.

The whole doctrine of centrifugal forces is contained in these eight propositions:—

1. The centrifugal forces of two unequal bodies moving with the same velocity, and at the same distance from the central body, are to one another as the respective quantities of matter in the two bodies.

2. The centrifugal forces of two equal bodies, which revolve round a central body in the same time, but at different distances from it, are to one another as their respective distances from the central body.

3. The centrifugal forces of two bodies which perform their revolution in the same time, and whose quantities of matter are inversely as their distances from the centre, are equal to one another.

4. The centrifugal forces of two equal bodies, moving at equal distances from the central body, but with different velocities, are one to another as the square of their velocities.

5. The centrifugal forces of two unequal bodies, moving at equal distances from the centre, with different velocities, are to one another in the compound ratio of their quantity of matter and the squares of their velocities.

6. The centrifugal forces of two equal bodies, moving with equal velocities at different distances from the centre, are inversely as their distances from the centre.

7. The centrifugal forces of two unequal bodies, moving with equal velocities at different distances from the centre, are to one another as their quantities of matter multiplied by their respective distances from the centre.

8. The centrifugal forces of two unequal bodies, moving with unequal velocities at different distances from the central body, are in the compound ratio of their quantities of matter, the squares of their velocities, and their distance from the centre.

Lond. Mec. Jour.

MR. HUNTER'S IMPROVED SCREW.

A new and very ingenious method of increasing the power of the screw, and of making it act with the greatest accuracy, has been invented by a Mr. Hunter.

This compound screw consists of two screws, one of which has a thread fewer in an inch than the male screw of the one in which it does itself move

Now, supposing the screw, A to have 20 threads in an inch, the screw, B, to have 21 threads in the same length; and the screw B, to be so fixed that it can move forward without moving round, then a single turn of the screw, A, will make the screw, B, advance 1 420th (20×21) of an inch.

Thus the compound screw produces an effect much superior to the common screw; for, to produce the same effect, a common screw must have 420 threads in an inch, which would weaken it so much that it would be unable to resist any considerable force. *ib.*

ON THE RUSSIAN WORKMEN.

The ingenuity of the common workmen or peasants of the Russians is very remarkable. His powers of invention are far from despicable, and his capacity for imitation altogether extraordinary. Whatever he sees in the mechanical arts he can almost to a certainty copy, though to a person in the same class of life in any other country of Europe it would offer insuperable obstacles. The faculty is perhaps Asiatic, for it also belongs in an eminent degree to the Chinese:—no other man within our pale of civilization executes so much and so well with such inadequate means. The Russians are ignorant in a great degree of all those scientific inventions among us calculated to supersede or to expedite human labour; yet in the most trying difficulties he is rarely at a loss, and ultimately is sure to conquer them. The model of a flying bridge of one arch, intended to cross the river Neva, and the conveyance to the capital of the rock upon which the statue of Peter stands, besides numerous other examples of ingenuity, are proud trophies to the capacity of the most illiterate boors. The carpenter's only implement is his axe, with which he performs with admirable neatness and precision all the delicate and complicated operations of his trade.

The workmen in Petersburg are the most rude and uncouth creatures imaginable; many, with long beards, and wrapped in sheep skins, looked like so many Orsons just returned from the woods. They are in fact all from the country. Brought up to an out-door trade, they gain permission from their landlords to seek out the best market for its exercise, usually Petersburg, Novogorod, Moscow, or some other large cities, by paying him an extra sum for the indulgence; but before their departure frequently marry and leave their wife behind, in the care of their father, who, exercising all the rights of the husband, cohabits, without reproach with his daughter-in-law, and perhaps rears a family of beings at once brethren and children to his absent son. This detestable custom, though checked of late years, still exists in a shameful degree. It seems so unnatural, that it must have originated from the recommendation of their lords, who are paid by the head instead of the acre, rather than from any natural perversity of proper feelings in the people. From whatever cause, however, it arises, it is an unquestionable proof of the most horrid barbarism.

Lond. Mec. Jour.

PREPARATION OF CARMINE.

The common carmine is made in France by boiling for a few minutes 1lb. of powdered cochineal in a copper, with five pails of water (of four gallons each,) and three drachms and a half Troy of salt of tartar; the violence of the boiling is stopped with cold water; and the copper being taken off the fire, eight drachms of powdered alum is then thrown in, which immediately renders the colour much more brilliant than it was. In about a quarter of an hour the cochineal settles at the bottom, and the liquor becomes quite clear, which is then to be poured off into another vessel, placed again on the fire, and some thin isinglass jelly added to it. As soon as the liquor boils, the carmine rises to the top of the liquor, and a coagulum is formed as when liquors are cleared with white of eggs. The vessel is then to be taken off the fire, and stirred with a wooden spatula; in about a quarter of an hour the carmine falls down, the liquor is then to be drawn off, and the carmine turned out on a fine cloth to dry. Instead of thin isinglass jelly, some use white of eggs; others both the white and the yolk. *ib.*

USES WHICH MAY BE MADE OF SULPHATE OF LEAD.

The dyers and calico printers, in making their acetate of alumine, as a preparative for certain dyes and colours, obtain at the same time a quantity of sulphate of lead; which is to them of no farther use.

M. Berthier has, in the Annales de Chimie, given a list of no less than seven processes by which some use

may be made in other arts of this residuum of the dye or colour house.

1. If the sulphate of lead is mixed with a sufficient quantity of charcoal dust, and the whole put into a retort, and heated just to redness, one half of the sulphuric acid contained in the sulphate is changed into sulphurous acid, which is of use in bleaching and whitening various articles. The sulphur belonging to the other half forms a subsulphuret of lead, part of which is carried over in the state of vapour, along with the sulphurous acid. When the heat applied is carried beyond redness, part of this subsulphuret is decomposed, and changed partly into another sulphuret which sublimes, and partly into lead, which remains mixed with that part of the subsulphuret that is not altered by the heat. The greater the heat, the more lead is volatilized.

The following experiments were made on small quantities: 100 grammes of sulphate of lead, mixed with 9 grs. of charcoal powder, yielded sulphurous acid gas for an hour, along with carbonic acid gas and oxygen gas; and a scoria-like mass of subsulphuret of lead remained in the retort.

10 grs. of sulphate of lead heated by itself, for half an hour, in a coated crucible in a wind furnace, left a scoria weighing 7 grs. 1 tenth; consisting of 6 grs. 7-tenths of lead with sulphur; hence, as sulphate of lead contains only 683 parts of lead in 1000, it is evident that very little lead was sublimed

The subsulphuret obtained in the first of these experiments, heated with sulphate of lead, yields metallic lead with very little loss; for, on mixing 20 grs. of sulphate with 29 grs. of the subsulphuret, putting them into a retort, and heating it to whiteness, pure sulphurous acid gas is evolved, and there were left in the retort 38 grs. of lead, covered with a thin crust of glass of lead: hence, as the original mixture only contained 40 grs. of lead, a loss of only five per cent. was sustained in this species of reduction.

It follows from these experiments, that if the sulphate of lead is heated with a small proportion of charcoal powder, sufficiently hot to reduce it entirely to sulphuret of lead, the portion of sulphuret which is formed will act upon the undecomposed sulphate; and if the proportion is so adjusted that the sulphuret and sulphate are to each other as 29 to 20, pure lead will be produced. The charcoal powder necessary for this purpose is 6 per cent. of the weight of the sulphate.

2. If sulphate of lead is heated to whiteness, along with three per cent. of its weight of charcoal, it yields a compact, glassy, transparent oxide or calx, of a fine resin yellow colour. The same oxide will be obtained if sulphate of lead is heated with 68 per cent. of lead; or with 73 per cent of subsulphuret of lead.

3. Sulphurous acid may be obtained from sulphate of lead; but as this could only be used for the production of sulphuric acid, as a substitute of sulphur, it is needless to say any thing more of this product.

4. 100lbs. of sulphate of lead, mixed with 79 of the common lead ore, called galena, and heated on the bed of a reverberatory furnace, yields about 137 of lead.

5. This sulphate may also be decomposed by the earthy basis of flints. 11 grammes of sulphate of lead, mixed with 16 of finely ground rock crystal, being kept red hot for an hour in a small Hessian crucible, a white spongy enamel was obtained, and the loss of weight was only three grains, and a third part, which is little more than the weight of the sulphuric acid contained in the sulphate. 3 parts of quartz and 12 of sulphate; as also 4 of quartz and 6 of sulphate, produced compact transparent yellow glasses, and the sulphate was in every case completely decomposed.

6. The sulphate of lead may be used for glazing pottery; and also employed in the manufacture of glass, in the place of red lead.

7. Sulphate of lead might even be changed into white lead, by the action of a subcarbonate of ammonia, or of potasse; but it is probable that

the colour of the white lead would not be so good, and the process would be dearer than the usual modes. *ib.*

ON THE MANUFACTURE OF STRAW HATS.

There are to be found in trade many kinds of straw plait and hats, the best of which are imported from Italy, in an undressed state. These Italian merchandises are either in the simple form of plait made from 7, 9, 11, or 13 slips of straw, either whole or divided; but sometimes in the form of hats ready made

Both these articles are made with the prepared straw of darnel grass rice, rye; but chiefly with the straw of a variety of spelt corn, *triticum spelta*, a kind of red wheat, grown very commonly in the Tuscan states.

Although it seems easy to imitate this manufacture, yet it has not fully succeeded either in France or England, in respect to the Italian hats of the best quality, known in trade by the name of Leghorn hats, but really manufactured by the girls of the vale of Arno, the Arcadia of Italy.

The Italian plait is said to be fine. when 14 or more sewn together do not exceeed four inches in breadth: they are called coarse if there are a less number than 14 in the same breadth: but the manufacture of both is exactly the same.

The manufacture is usually carried on by women, who are commonly more adroit than men in works which require much care attention and patience; and it may easily be conceived how very difficult it must be and what patience it must require to prepare the straw, split it, plait it, and perform all the other operations, without breaking it

The straw having commonly a more or less deep shade, it must first be bleached. For this purpose, it is sometimes tied up in small bundles, dipped in boiling water, untied, and spread out to dry; if not yet white enough, it is put into a small closet or box, and some lighted brimstone being also put into the place, at a distance from the straw, the closet is shut up close for some hours. The bleached straw is then placed between two very damp coarse cloths, and left for three or four hours, that it becomes sufficiently moist to be supple.

This being done, the knots are cut off, and the straw, unless it be to be used whole, is split lengthways by the point of a penknife, into three or four parts; they are then moistened again, that they may be flattened, and form as it were little ribands; and are then, after being kept flat for three or four hours, ready to be plaited.

The plaiting is performed by the hand. The manner of performing this operation, when thirteen strips are used, requires much attention, not only for the closeness, but also the regularity of the plait. The female who plaits must keep her fingers constantly moist, for otherwise the straw would lose its suppleness and flexibility.

In order to make extraordinarily fine straw hats, the straws are divided into a greater number of strips; but then the point of a knife can no longer be used. This division is performed in Italy by means of a row of very small fine needles, such as are used to embroider upon muslin; they are kept in their place by their heads being connected by rosin. On passing a strip of straw, after it has been divided by the knife, and flattened, between these needles, it is divided into several strips, much smaller than before, but not so fine as the strips of straw used for making flowers and other ornaments, which are divided in the same manner. In England, the straw is pushed through a cone, the smaller end of which has a number of teeth, which divides the straw into strips more or less fine.

The plait being thus made of a proper breadth and length, according to the work for which it is designed, is delivered to other workmen, who sew it together, by forming it into a spiral, and sewing the edges together, either merely touching one another, or overlapping one another, care being taken in each case that the threads by which the edges are joined shall not appear.

However well the plaiting of these hats is executed, they require to receive a finishing, which may give them an even brilliancy and regularity of surface. There are two methods for giving this final dressing to these hats: the use of a press, and that of passing a heated iron over them.

For the purpose of pressing the hats, the plait is moistened either with rice water, very thin starch, or weak gum water, and dried; after which the hats are piled one upon another, with boards placed between each, the boards being previously well warmed; and the whole is strongly pressed, and left in the press for several hours, generally a day and night. As only a small part of the hats can be pressed at once this process is very tedious, notwithstanding the number that are pressed at the same time. The edges are first pressed, then the sides of the crown, and lastly the top of the crown.

The process with the hot smoothing iron is much quicker; the hat is dressed with the mucilaginous dressing as in the other method, and is then run over with a heated smoothing iron of a proper shape, or with an iron box containing either a mass of heated iron, or a charcoal fire. As this also takes up much time when the iron is moved by the hand, machines have been invented to accelerate the work, and increase the pressure by means of a lever, to which the ironing apparatus is annexed. In some the iron box is immoveable, and the hat moved under it by the action of the machine; and in others the box sliding on a lever is moveable at pleasure, and made to press on the hat placed on blocks of various forms. By these machines a workman will finish ten dozen of hats in a day; whereas he could only finish two dozen in that time by a plain smoothing iron.

Straw plait may be dyed; but this is seldom done. Old straw hats are however frequently dyed black. *b*

ON GRAPE DRINK.

There is prepared, at Paris, and in many other places, a very wholesome drink from grapes, and which is at the same time cheap.

This drink is made by filling a pipe from which brandy has lately been drawn with bunches of the ripest black grapes that can be procured, taking care not to squeeze them. The head of the vessel is then put in, and being laid on stillions, it is filled up with soft water; some add a quart of brandy; the bung hole is then covered with a moist cloth, and that by a flat stone.

In a few days it begins to ferment; the skins soften and the colouring matter is dissolved; a week afterwards a sufficient quantity of *piquette*, as it is called, is drawn off, for the consumption of the day, and the pipe is filled up with water. If the quantity drawn off does not exceed three quarts a day, the piquette becomes stronger every day, for the first six weeks: after this it loses its strength by degrees, and at the end of six weeks more, or three months from the beginning to use this drink, it is found as strong as at first. After this it becomes gradually weaker, and the vinous taste is succeeded by acidity: but the continual drawing off a part, and the addition of water, prevents the putrid fermentation from taking place: hence the piquette does not contract any bad taste, not even when it has become very weak: indeed the grapes may be totally exhausted of their soluble matters by the repeated addition of water. When, however, the piquette becomes extremely weak, it is usual to add a tenth part of some cheap wine, at the time of drinking. Sometimes, on the other hand, this grape drink is used instead of water to mix with wine.

Many other drinks of a similar nature are prepared from different substances, as apples or pears, cut in two or three pieces: roots of liquorice, the branches of sugar-maple, and the like. Sometimes chips of resinous woods, hops, aromatic or bitter herbs, cut into shreds, are added, to assist in the keeping of the liquor.

The piquette of grapes is, however, that which keeps its vinous taste the longest, and its taste is far more

agreeable than that of any other similar liquor.

Lond. Mec. Jour.

MR. NIMMO'S RULE FOR THE USE OF OAK BEAMS.

Divide 651 by the length of the beam, taken in feet, subtract 10 from the quotient: multiply the remainder by the product obtained by multiplying the breadth and the square of the depth, both taken in inches. This last product will be the greatest load an oaken beam will bear, and which indeed will break it in a few minutes.

One half of the load thus found may be safely laid on the beam, but it will give the beam a set from which it will never recover.

A third of this load may be laid upon the beam for any length of time, without injury. *ib.*

ON SOAP.

Our ancestors were accustomed, as appears from several ancient manuscripts, to make their soap ley not of pure water, but to boil green oak bough's bark in the water of which the ley was made, or to add French red wine lees. This formed what they called black soap

To convert this black soap into white, they order the black soap to be beat up with one-eighth of its weight of common salt, and then melted with a little water. *ib.*

CONCENTRIC CHUCK FOR TURNERS.

Invented by E. Speer, Esq.*

This Chuck consists of hollow truncated cones, fitting, with tolerable accuracy, into each other, the outer one screwing on to the mandril of the lathe, and turned like a common chuck; at the bottom is a detached circular plate of brass to force the cones out, in case of any adhesion; but I have never found this necessary. It is calculated to obviate a necessity for numerous chucks which are applicable to different kinds of work, and to save a great deal of time, which is lost in preparing materials, when in the rough, for turning; in fact, it may be called a universal chuck, whenever the back-puppet is in use.

Every one acquainted with turning is aware of the trouble attending the first fitting a piece of wood to the lathe, which seems by this contrivance, simple as it is, to be entirely obviated. Nothing more is necessary than to remove one or more of the internal cones, till there is sufficient room for the admission of the substance to be operated upon; and it affords particular facility for removing any work from the lathe (a screw, for instance) which may require to be accurately fitted before it is finished.

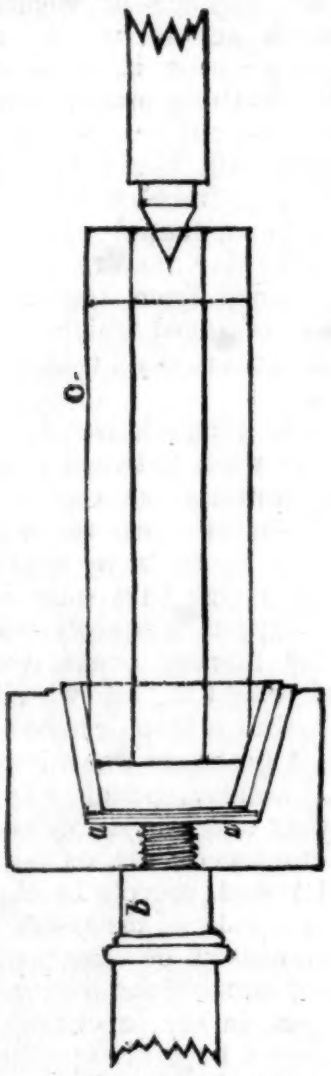
The present chuck is adapted to receive any work between three and three-quarters and one-eighth of an inch in diameter; but there can be no objection to its being carried to any extent in size that may be required. It appears equally well calculated for turning brass, iron, or steel, the chucking of which is, in general, rather a troublesome operation; and it possesses one advantage, which is, I believe, peculiar to itself, namely, that it is impossible to injure the tool employed; for, as the work is carried round, merely by the friction on the inside of the cone, which may be increased or decreased at pleasure, by moving the screw in the back-puppet, in the event of a tool encountering a knot, or any other impediment, this friction is invariably overcome with less violence than would be requisite to break the point of the tool, and the work remains stationary.

The cones of this chuck are turned at an angle of about from ten to twelve degrees; but whether this may be the best proportion I am not prepared to say; probably, if it should come into general use, the angle might be determined by the kind of work to be performed.

I have had a chuck of this kind made in brass, with the cones of iron,

* The Society of Arts has voted its large silver medal to Mr. Speer for this invention.

but it is cumbrous and expensive, and does not answer so well, owing to the surface of the iron offering less resistance to the work within it. This perhaps might be remedied by roughing; but I think the chuck is much better in wood, as it can be made by any common turner at a trifling expense, and possesses more strength than can possibly be required.



Description.

The preceding figure is a section of a chuck, which consists of several hollow cones, placed one within another; the whole of them may be removed by pushing a pin through the screwed hole in the back of the chuck against the plate, *aa*; the plate, *aa*, must then be replaced. The hollow cones or chucks may then be easily pushed out from within one another, till one is found that will receive the end of a piece of wood, &c, that is intended to be chucked; they must then be replaced in their respective situations, in the largest chuck, and screwed on the end of the mandril, *b*, of the lathe, as represented in the figure. The piece of wood, *c*, intended to be chucked, must then be pushed into the hollow cone, and the conical centre, *d*, (of the back puppet) must be screwed against the end of the wood, which will cause sufficient friction within the chucks, so that the mandril will turn round the chucks and the wood together.

These chucks will be found particularly convenient for chucking the outer end of any irregular piece of wood, when the centre, *d*, can be applied to the opposite end of it; and also for chucking a piece of wood that has been turned, when the centre has been cut off one of its ends. The chucks may be made of box, or any other hard wood that is not easily split.

Lond. Mec. Mag.

ACCOUNT OF MR. FERGUSON, LECTURER ON MECHANICS.

The writings of Mr. Ferguson are justly distinguished for their perspicuity and plainness; and afford an example of a self-taught mechanic acquiring considerable fame as an author; and he has prefixed to his Select Mechanical Exercises an excellent account of his own life until that period.

He was born in 1710, near Keith, Banffshire, Scotland, his father being a small farmer there. While his elder brother was being taught to read, he used to study in private the lesson his brother had been reading, and occasionally applied to an old woman in the neighbourhood for assistance; by which means he acquired the power of reading tolerably well before his father thought of teaching him. When his father discovered the knowledge he had thus acquired, he taught him writing, and sent him for three months to the grammar school, which was all the school learning he ever had.

His genius for mechanics was developed by seeing his father lift a spar with a lever; upon which young Ferguson investigated the power of the lever and wheel axle; while, fortunately for him, his father had a lathe, which allowed him to make wheels and other things fit for his researches. He drew up an account of these experiments, fondly supposing they were new discoveries; but on showing it to a gentleman he was convinced of his mistake.

His father not being able to maintain him at home for study, he went into service as a shepherd, when he began to study astronomy. His second master encouraged him in this study, and often

worked himself, that Ferguson might make fair copies of his observations on the night. The minister of Keith lent him some maps, which he copied; and when he took home the copy, a neighbouring gentleman, seeing his genius, offered him the use of his house, and the instruction of his butler, another self-taught scholar;—but this person leaving the family and going some miles off, Ferguson also left, and served successively two bad masters—a drunken miller, who left all the work to him, and at the same time half starved him; and a farmer-physician, who promised to teach him his profession, yet never let him have the sight of a single book; and not only overworked him and neglected the care of his health, but when hurt by accident, and obliged to leave his service, with the probability of never recovering the use of his left arm, did not once call to see him at home, and even refused to pay him any wages, because he had not completed his term of service.

While recovering from this accident, Ferguson made a wooden clock, with a broken bottle for a bell, which kept time pretty well. Having at that time no conception of the moving power of a watch, he took an opportunity of asking a gentleman riding by what it was o'clock, who, pulling out his watch, Ferguson asked farther to see the inside of it. The gentleman good-naturedly allowed him to inspect it himself, and answered his questions respecting the spring. From this insight into mechanism, Ferguson attempted the making of a watch with wooden wheels, in a wooden case little bigger than a breakfast tea-cup; the spring being a slip of whalebone in a coil; but his success was not complete; and the poor watch itself soon fell a victim to the awkwardness of a clumsy neighbour, who let it fall, and turning hastily to pick it up, set his foot upon it, and crushed it to pieces.

On his recovery he applied to Sir Jas. Dunbar, who, seeing his ingenuity, first employed him in cleaning his clocks; and letting Ferguson use his house as a home, the latter began to get a little money, first as a clock cleaner, and afterwards as a pattern drawer for the ladies; which led him to copy pictures and prints. From hence he went to a nephew of Sir James', where he began to practise portrait painting; and he says he found it was much easier to draw from the life than from any picture whatever; as nature is more striking than any imitation of it.

His friends now endeavoured to get a subscription to put him to some painter at Edinburgh; but nothing of any consequence could be collected; and the painters would not instruct him without a premium, or seven years' service, maintaining himself. In this dilemma, the Rev. Dr. Keith advised him to rely on his own exertions for success in painting—and he practised it for twenty-six years as a means of support. But this art was not sufficiently mental for the genius of Ferguson; and for two years he studied medicine at Edinburgh.

After this, he turned his mind and hands to the construction of orreries, and in 1743 came to London, when he commenced as a portrait painter; but still employed his leisure in constructing small pieces of machinery—one of which for showing that although the moon goes round the earth, and that the sun is far on the outside of the moon's orbit, yet the moon's motion is in a line that is always concave towards the sun, caused his introduction to the Royal Society, and his acquaintance with Mr. Ellicott the watchmaker.

In 1747, he ventured to appear in print in a Dissertation on the Harvest Moon, not without fears, arising from his want of a regular school education; but finding his first work well received, he grew bolder, and published several other works, all of which have been uncommonly well received by the public, and exhibit a peculiar talent for writing on philosophical subjects with great accuracy and precision, for simplifying whatever is complex, and for rendering intelligible to the lowest capacities whatever is usually considered as abstract and above their comprehension. For some portion of this well-earned fame he is indebted to the very cause of his fears Knowing no language but his native tongue, his writings are purely idiomatic, and never disgraced with that bastard English speech which is so generally employed by writers on the sciences.

The next year he ventured to read lectures on astronomy; and began to make an apparatus for lectures on mechanics, which he gradually increased. Finding success in this undertaking, he entirely left off painting, and confined himself to lecturing. His majesty, the late king, who took great pleasure in conversing with Mr. Ferguson, allowed him a pension of fifty pounds a year, as a mark of his favour.

While thus enjoying, in the evening of life, the respect of all who knew him, he died, after a lingering illness, on the sixteenth of November, 1776, in the sixty-sixth year of his age. *Lond. Mech. Jour.*

PREPARATION OF BISTRE.

Amateur draughtsmen usually make their chiaro scuro drawings with Indian ink or sepia; but professed painters employ mostly bistre for this purpose, which gives a better effect than Indian ink—less glaring to the eye; and hence presenting to the accomplished artist a chaster effect than the more violent contrast of direct black and white.

Bistre is in fact nothing but the soot of chimneys under which wood only is burned. The most compact pieces are chosen; and those which, when broken, present a close shining surface. These pieces are broken, ground, and sifted; the powder is soaked in clear warm water, and stirred repeatedly: after some time, the water is poured off, by which means the soluble part of the wood soot is extracted, which would prevent the drying. If it be thought necessary, more warm water is poured on the ground wood soot; but this is seldom done.

When the wood soot has thus been cleared of all its saline particles, it is again mixed with water in a deep vessel, with a cock at some distance from the bottom. The whole is stirred, and after the grosser particles have settled, the cock is turned and the turbid water above it drawn off into another vessel, where the bistre settles by degrees. By repeating this washing several times, the bistre is brought to a state of great fineness, and will lay a smooth shade of colour. The grosser particles, which are not brought over, may be ground on a stone, and again washed over.

To use this bistre, it is mixed with gum water; for it is only employed in water colours, and not at all with oil. *ib.*

ON BAKER'S REGULATING SCREW FOR THE MAIN-SPRING OF FIRE ARMS.

Mr. Ezekiel Baker's invention consists of a regulating screw-pin, which is placed behind the hammer, through the solid piece of the plate. This pin, when screwed down, acts upon the short side of the main spring, by forcing which its strength is increased, and more fire is consequently drawn from the hammer. On the other hand, when a new flint is introduced, the power of the main-spring may be lessened by turning the screw pin backwards, by which means the flint is prevented from breaking, as frequently happens when it is put into a lock of the present construction. All this may be easily effected by the soldier, with the common turnscrew which he always carries with him to put in his flint, &c. This will not add to the expense of new fire arms: but most old firelocks will require a new main-spring, as the stud which holds it steady on the plate is usually placed on the middle of the short side of the spring, and consequently the regulating screw applied to these old locks may perhaps break itself or the main-spring. In a new lock the stud should be placed on the bend of the spring, which enables it to play at pleasure, without any fear of either the one or the other being injured. The hole in the eye of the spring is oblong, so as to enable it to play more easily up or down, as occasion may require, than a round hole admits.

This invention may be applied, with equal effect, to door-locks and spring bolts of every description, when the springs lose their power from weakness, or any other cause. *ib.*

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